

Flux gain for a next-generation neutron reflectometer resulting from improved supermirror performance



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**Oak Ridge National Laboratory /
Spallation Neutron Source Project**

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The Spallation Neutron Source SNS

A next-generation neutron source at Oak Ridge Nat. Lab.

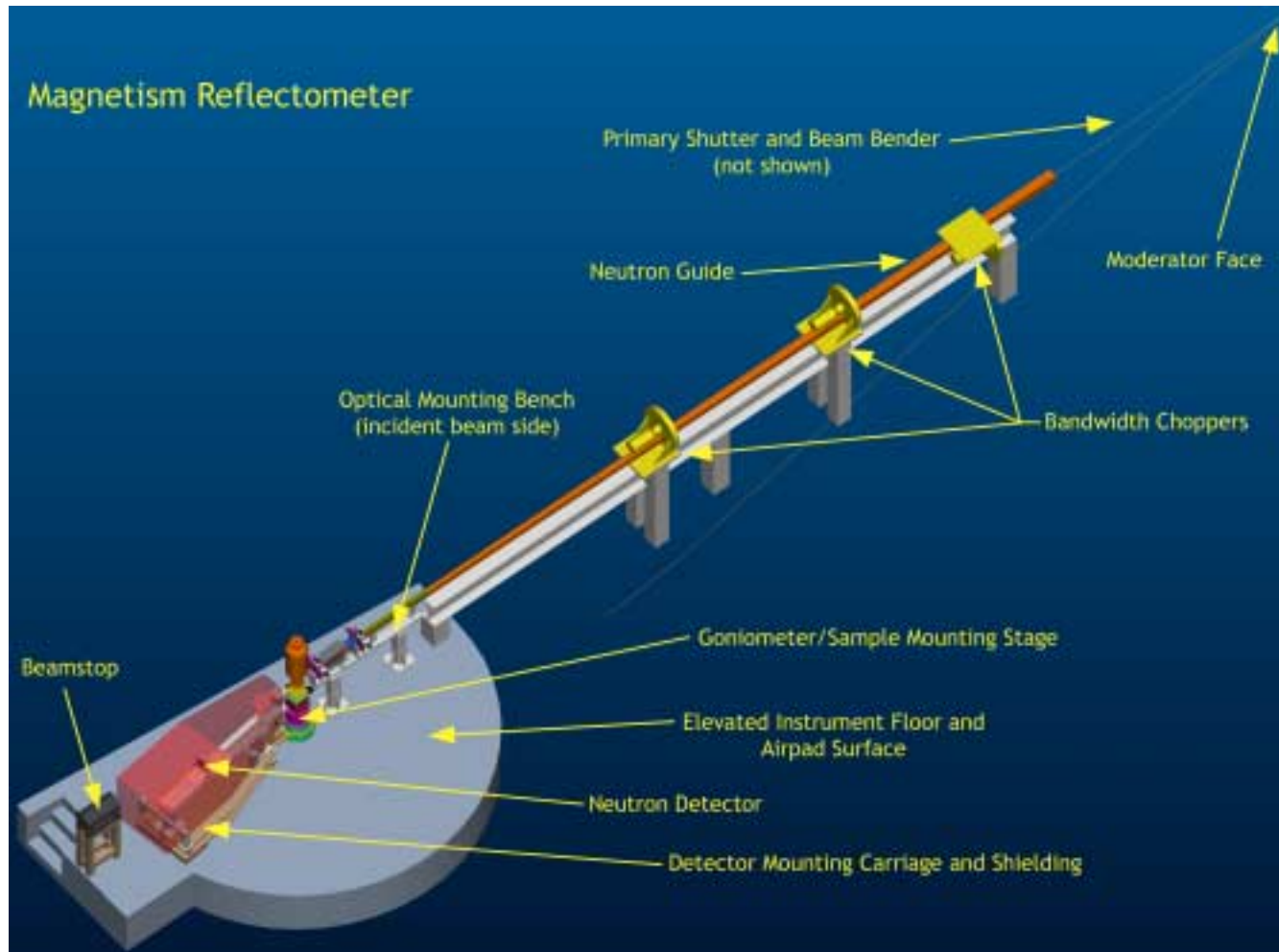


Beam power: 2 MW

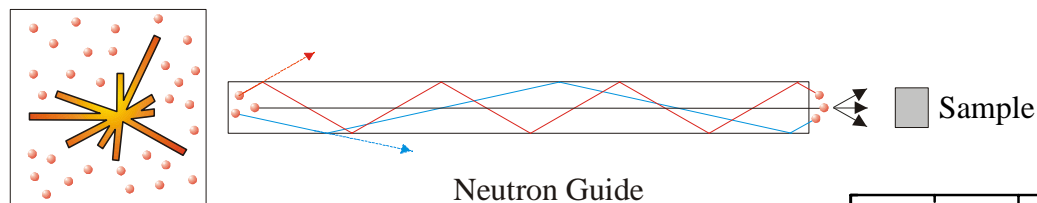
Gain in effective flux: 10-100 times

The SNS Magnetism Reflectometer

designed for reflectometry and high-angle diffractometry on thin films

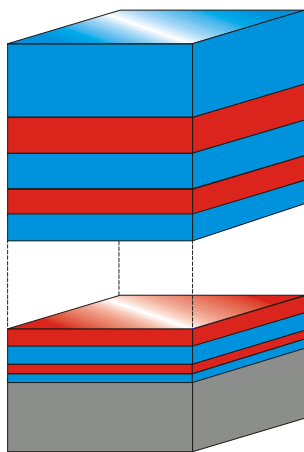


Neutron guides and supermirrors

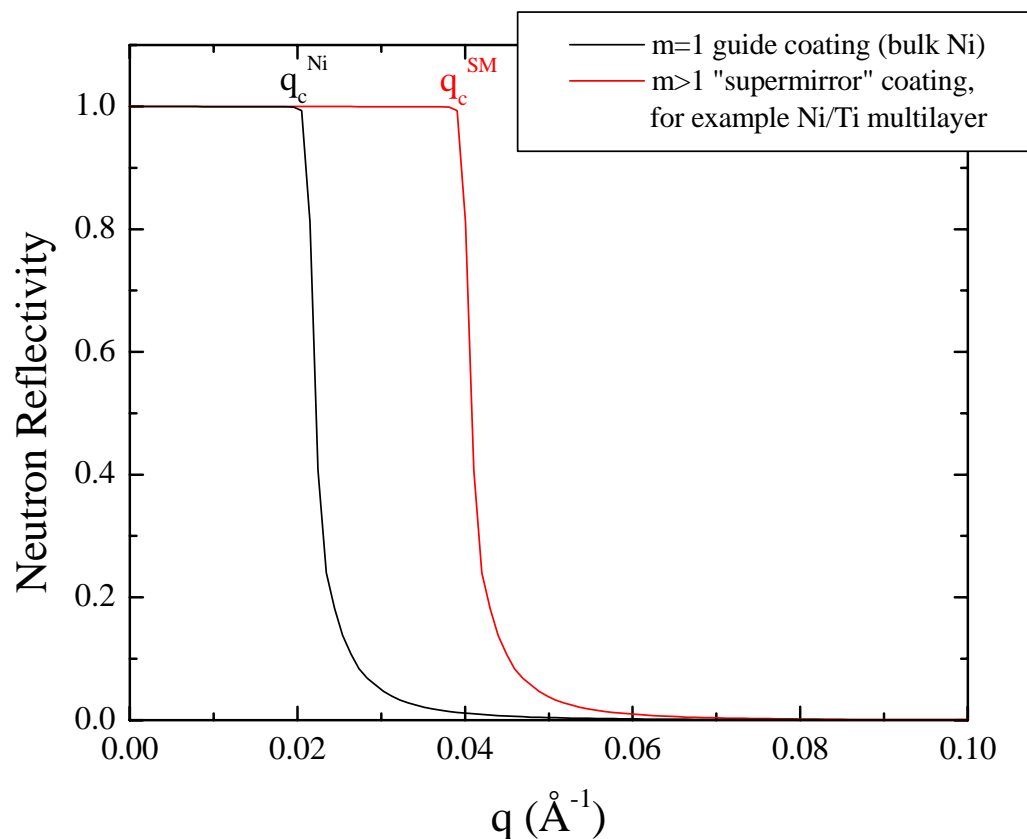


Source

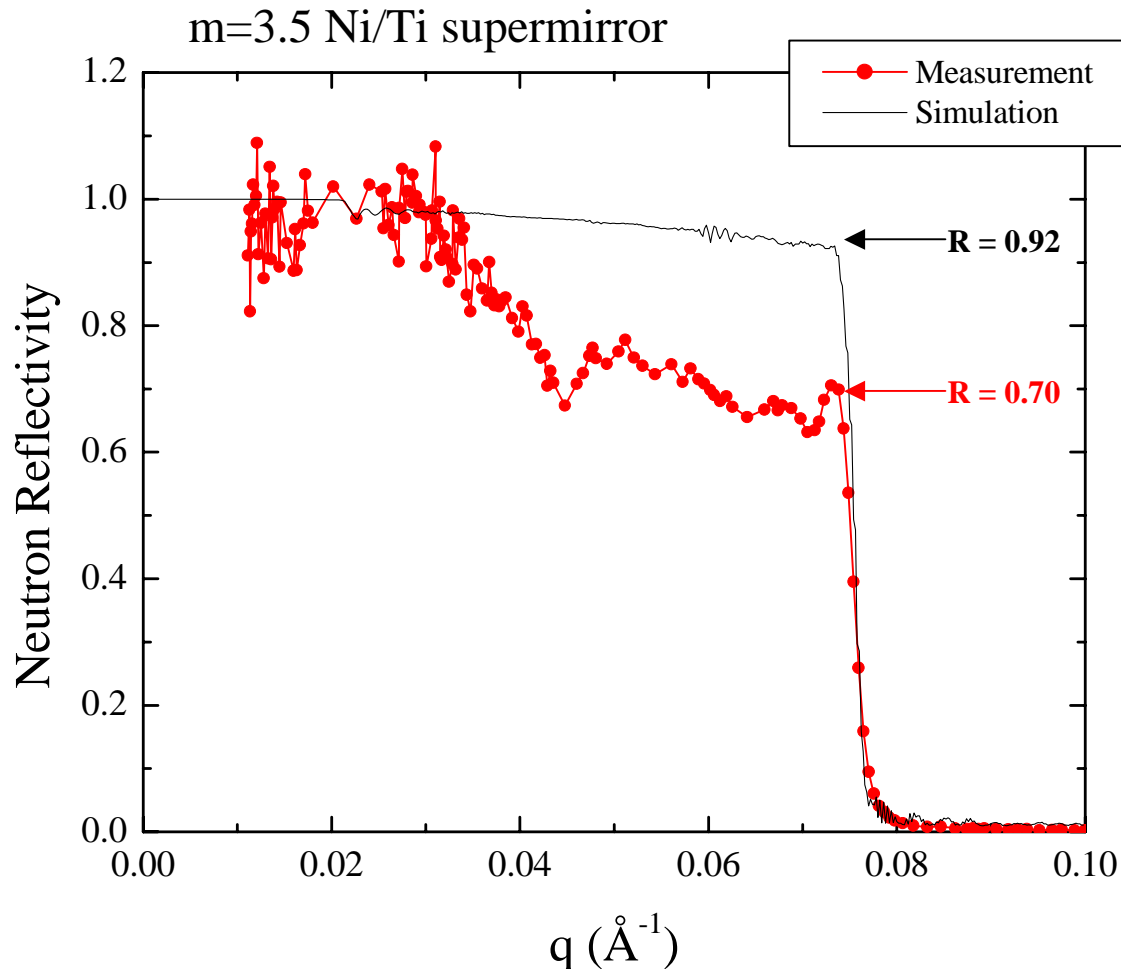
$$q_c^{\text{SM}} = m \times q_c^{\text{Ni}}$$



Aperiodic supermirror



High-m supermirror imperfections

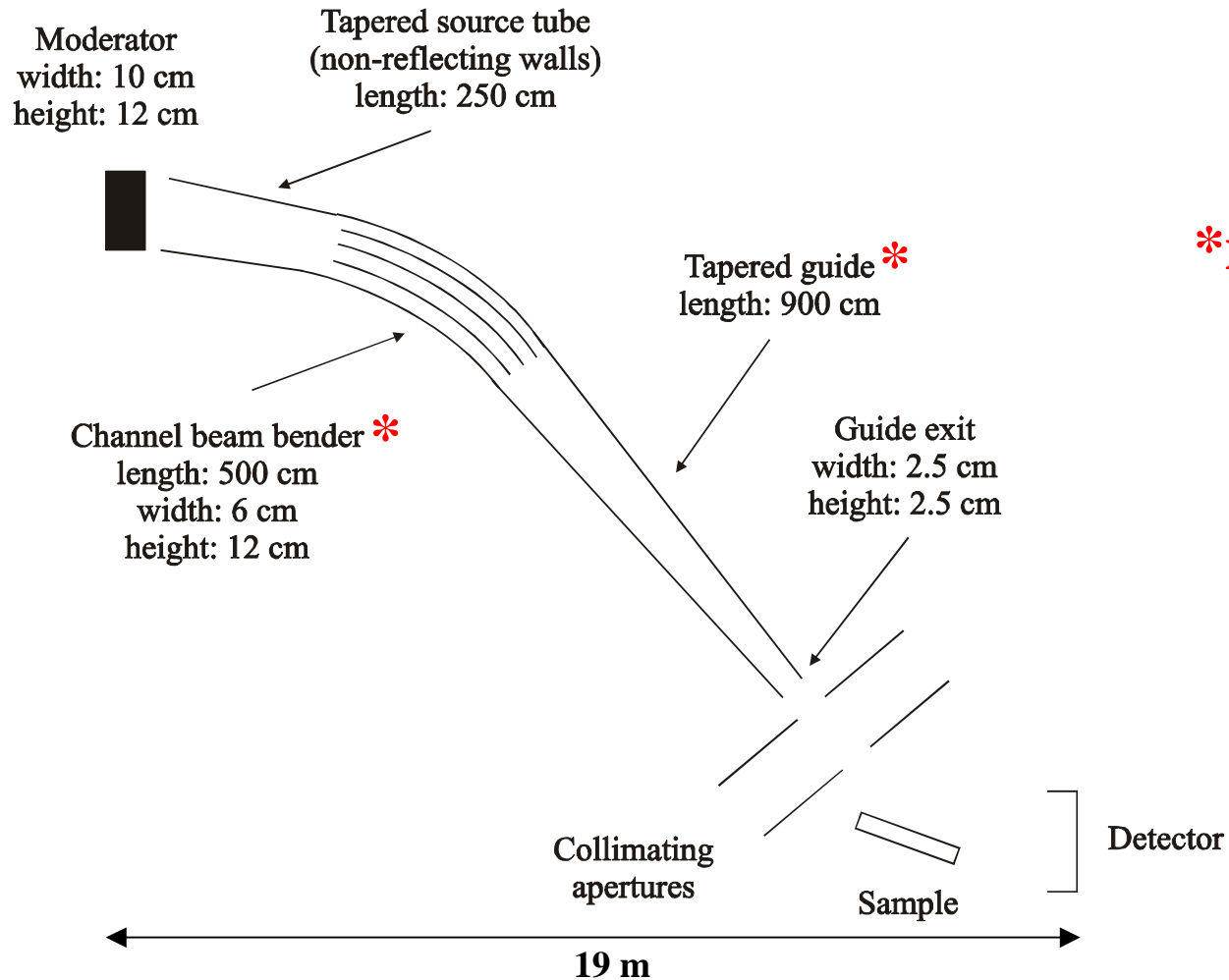


Reasons for low reflectivity:

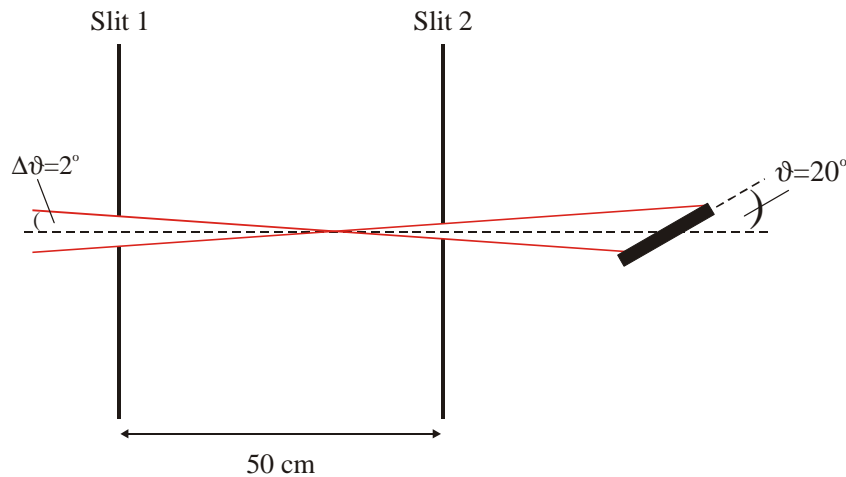
- Absorption
- Incoherent scattering
- Roughness (10% of d_{layer})
(included in simulation)
- Interdiffusion?
- Limited coherence
introduced by layer thickness
fluctuations?

The SNS Magnetism Reflectometer

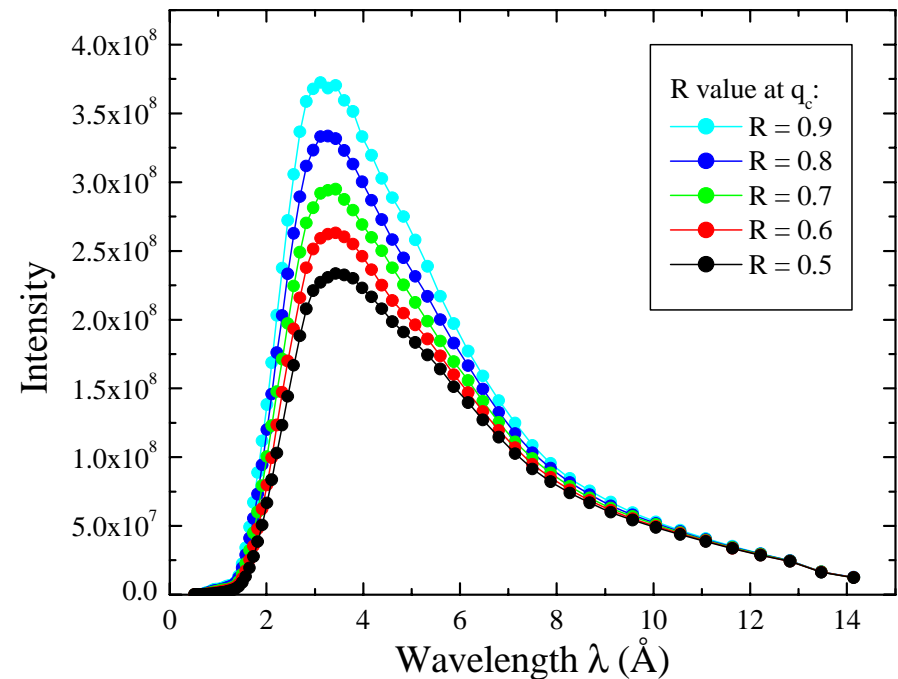
(top view, schematic)



Performance gains for the SNS Magnetism Reflectometer

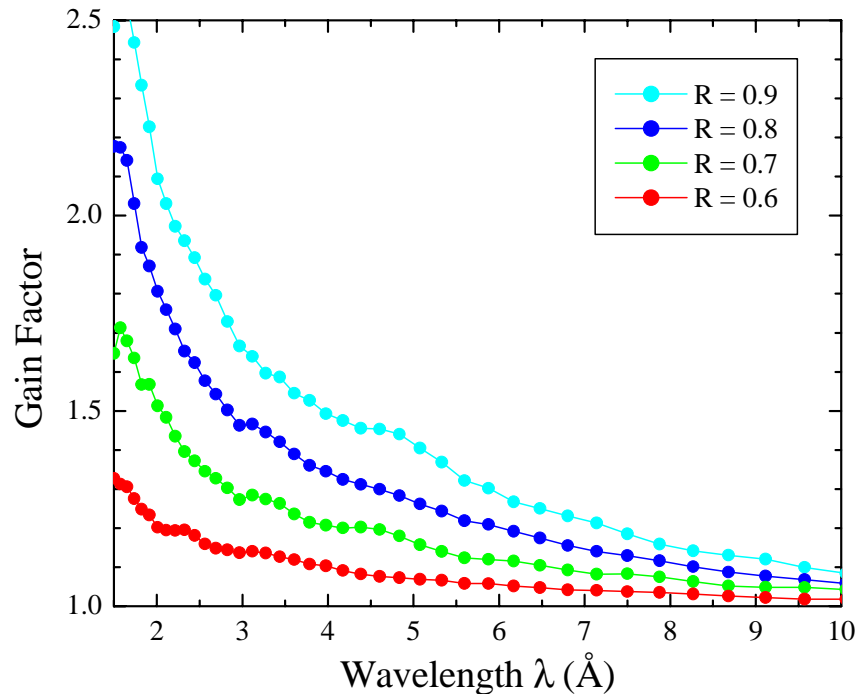


Experimental set-up



**Neutron intensity on sample
in 5% wavelength bins**

Performance gains for the SNS Magnetism Reflectometer



Gain relative to R=0.5 coating

Conclusions

- Flux enhancements as high as 40% maybe achievable if R values of 80% could be reliably reached.
- Largest enhancement would be achieved for smallest wavelengths.
- R&D money is well spent in this area because improvements on the SNS accelerator are much more expensive.

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